

other buffer layer **422** may be positioned between the active layer **230** and the metal-chalcogenide layer **240**. In the embodiment of FIG. 4, the other buffer layer **422** may include a layer of germanium-selenide that is not co-deposited with the same metal as the active layer **230**. The other buffer layer **240** may enable better tuning of the device **400**.

[0046] Referring to FIG. 5, a flow chart depicting an embodiment of a method **500** of forming a variable resistance memory device wherein an active layer includes a metal is depicted. The method **500** may include forming a first electrode, at **502**. For example, one or more of the electrodes **110**, **210** may be formed by depositing a conductive material on a semiconductor wafer.

[0047] The method **500** may also include forming a buffer layer, at **504**. For example, one or more of the buffer layers **120**, **220** may be formed by depositing a glass material on the electrodes **110**, **210**.

[0048] The method **500** may further include forming an active layer by co-sputtering a metal material with a glass material, at **506**. For example, the one or both of the active layers **130**, **230** may be formed by co-sputtering a metal with germanium-selenide.

[0049] The method **500** may also include forming an ion source structure, at **408**. For example, one or more of the ion source structures **150**, **250** may be formed by depositing a first glass layer (e.g., the glass layer **251**), forming a metal layer (e.g., the metal layer **254**), and forming a second glass layer (e.g., the glass layer **252**).

[0050] The method **500** may include forming a second electrode, at **510**. For example, one or more of the electrodes **160**, **260** may be formed by depositing a conductive material (e.g., tungsten) on the wafer.

[0051] Although not depicted in FIG. 5, the method **500** may include one or more additional processes, such as one or more deposition process or one or more etching process. Further, additional layers and structures (e.g., insulating layers, metal routing layers, via structures, and spacer structures) may be formed on or between the layers described herein.

[0052] Referring to FIG. 6, a flow chart depicting an embodiment of a method **600** of forming a variable resistance memory device where an active layer includes germanium-telluride is depicted. The method **600** may include forming a first electrode, at **602**. For example, the electrodes **310** may be formed by depositing a conductive material on a semiconductor wafer.

[0053] The method **600** may further include forming an active layer by co-sputtering carbon with germanium-telluride, at **604**. For example, the active layer **330** may be formed by co-sputtering carbon with germanium-telluride. Alternatively, one or more other doping process may be used to introduce the carbon into the germanium-telluride.

[0054] The method **600** may also include forming an ion source structure, at **606**. For example, the ion source structure **350** may be formed by forming a depositing a first glass layer (e.g., the glass layer **351**), forming a metal layer (e.g., the metal layer **354**), and forming a second glass layer (e.g., the glass layer **356**).

[0055] The method **600** may include forming a second electrode, at **608**. For example, the electrodes **360** may be formed by depositing a conductive material (e.g., tungsten) on the wafer.

[0056] In accordance with the systems and methods described herein, tin may be particularly effective in altering

the formation of conductive channels within the chalcogenide glass due to the particular physical and chemical properties of the tin. In particular, the inclusion of tin may enable the electrical properties of the device to be modulated as opposed to other types of metals. The resistance ranges, switching speeds, and data retention may be affected by this change in the active glass layer. As such, an active layer that includes tin may be more effective in enable the tuning of a resistance exhibited by a device in some applications than embodiments that do not include tin within the active layer.

[0057] As explained above, referring to FIG. 1, the metal-co-deposited-glass layer **130** may include one or more metals co-deposited with a chalcogenide glass. In some embodiments, the one or more metals may include tin. Likewise, referring to FIGS. 2 and 4, the active layer **230** may include germanium-selenide co-sputtered (or otherwise doped) with tin. Referring to FIG. 7, a block diagram depicting an embodiment of a variable resistance memory device **700** where at least one metal within an active layer **730** includes tin is depicted.

[0058] Although various embodiments have been shown and described, the present disclosure is not so limited and will be understood to include all such modifications and variations as would be apparent to one skilled in the art having the benefit of this disclosure. Further, it should be understood that the disclosure is not intended to be limited to the particular forms disclosed. Rather, the intention is to cover all modifications, equivalents and alternatives falling within the spirit and scope of the disclosure as defined by the appended claims.

1. A variable resistance memory device comprising:
 - a first electrode and a second electrode;
 - a chalcogenide glass layer between the first electrode and the second electrode, the chalcogenide glass layer including a chalcogenide glass material co-deposited with a metal material;
 - a metal ion source structure between the chalcogenide glass layer and the second electrode;
 - a metal chalcogenide layer between the chalcogenide glass layer and the metal ion source structure;
 - a buffer layer between the first electrode and the chalcogenide glass layer, wherein the buffer layer includes the chalcogenide glass material and excludes the metal material; and
 - a second buffer layer between the chalcogenide glass layer and the metal chalcogenide layer.
2. The device of claim 1, wherein the metal material includes tin.
3. The device of claim 2, wherein the metal material includes chromium, tungsten, copper, cobalt, indium, or a combination thereof.
4. The device of claim 1, wherein the chalcogenide glass material includes germanium selenide.
5. (canceled)
6. The device of claim 1, wherein the metal ion source structure includes:
 - a first adhesion layer and a second adhesion layer; and
 - a mobile metal layer between the first adhesion layer and the second adhesion layer.
7. The device of claim 6, wherein the first adhesion layer and the second adhesion layer include the chalcogenide glass material.
8. The device of claim 6, wherein the metal layer includes silver.